# Welcome

to the

# Solar Sail Technology & Applications Conference

Greenbelt Marriott
Greenbelt, MD
28-29 September 2004

- Introduction
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    Sun-Earth Connection Program
    NASA/GSFC Code 460

  - Also the study lead for the 4-NASA-Center, ST9 Solar Sail Flight Validation team

- Agenda changes

# “A series of unfortunate events” for the solar sail

- Comet Halley—daring heliogyro that would take only 4 years to rendezvous with Halley, cancelled
- Shuttle deployment test—planning for mission aborted by Challenger?
- Solar sail regatta—race to the Moon declared, but no concepts actually flown
- Znamya—20-m space reflector, flew on Progress s/c in 1992, partial success
- DLR/NASA demo—ground demonstration only
- Solar Blade—heliogyro concept in University Nanosats, engineering hardware built, severely underfunded
- ST5, ST7—system validations
- ST6, ST8—deployment validations
- Others?...

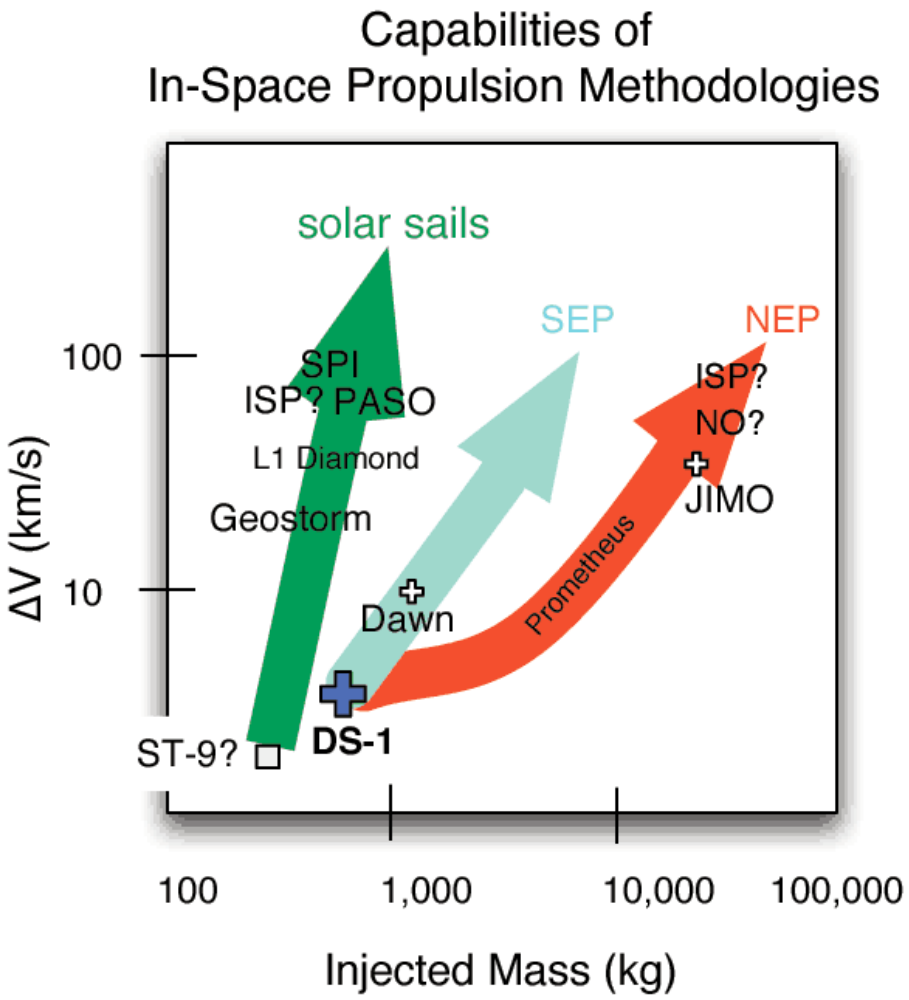
# Motivation,
# Means,
# & Opportunity

# Motivation for the sail

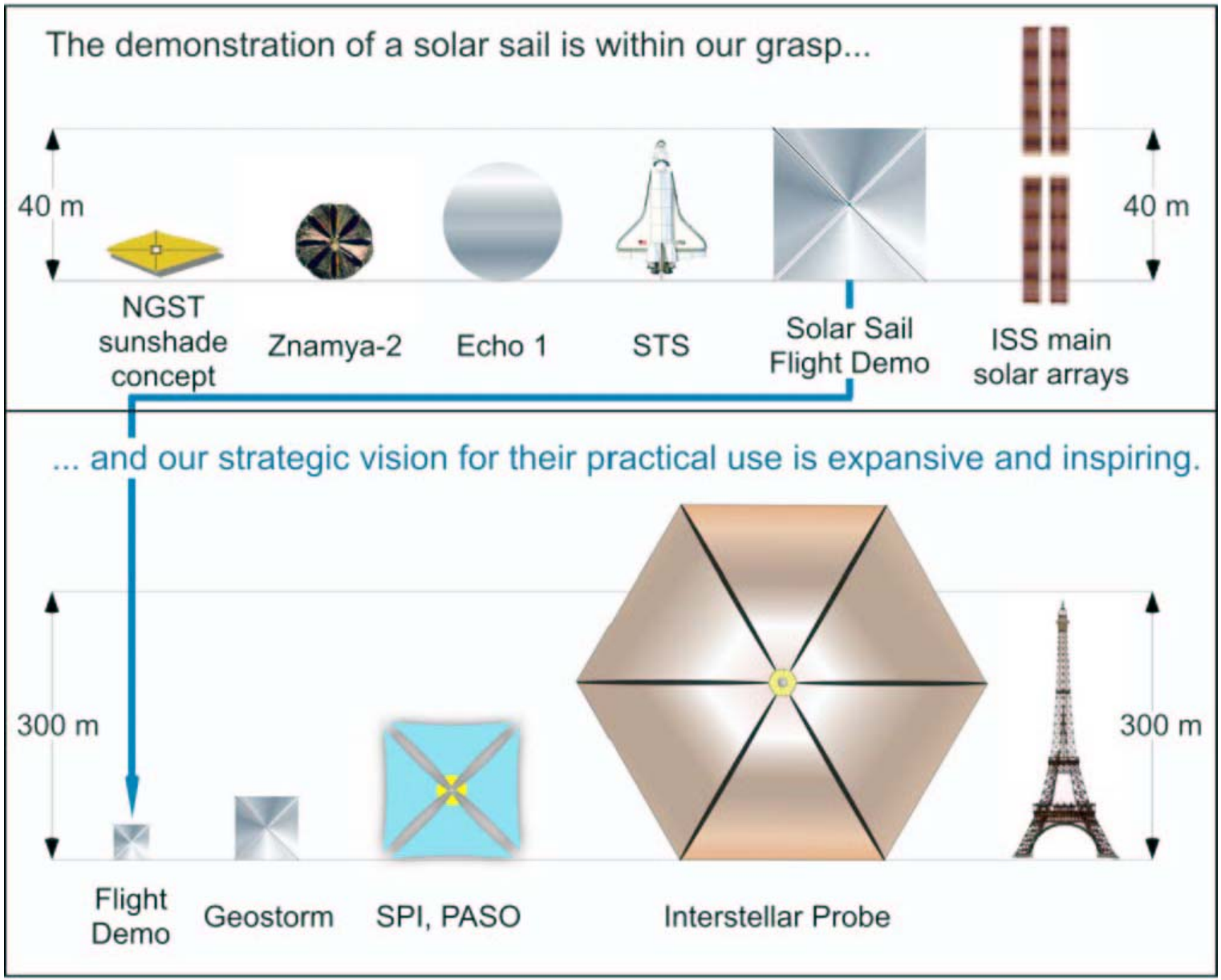
- Tangible link to humankind's maritime tradition...
- Intriguing challenge for materials, mechanical, and space systems engineering...
- Propellant-less nature of propulsion...
- Affinity for solar-powered, space solutions...

# Enduring motivation for NASA's interest in the solar sail

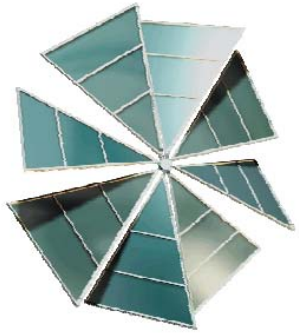
**High-performance, cost-effective propulsion method for medium-class robotic payloads in the inner solar system**

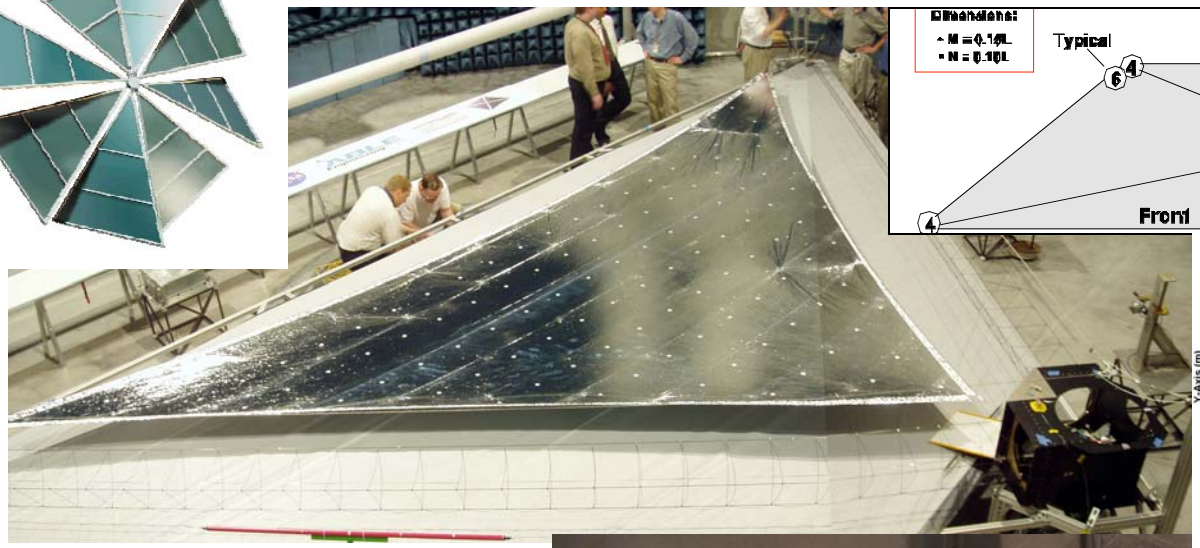


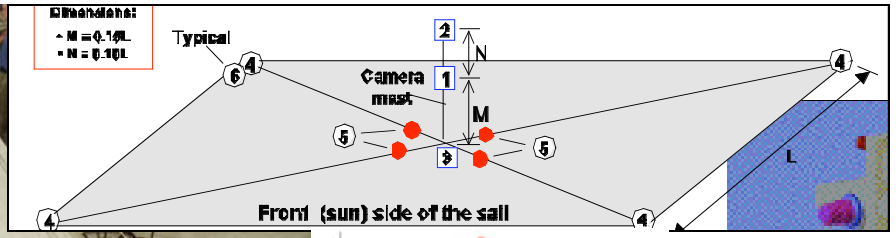
# Scale Comparison for Solar Sails

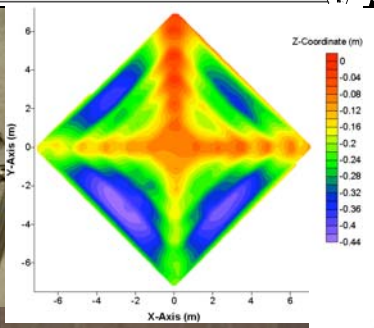


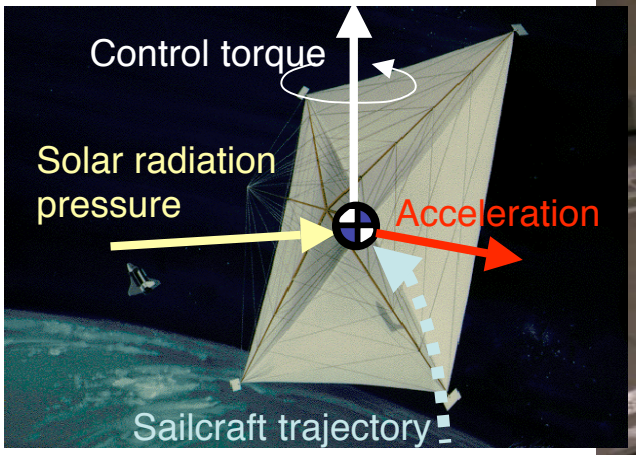
# In 2004, *abundant* means...

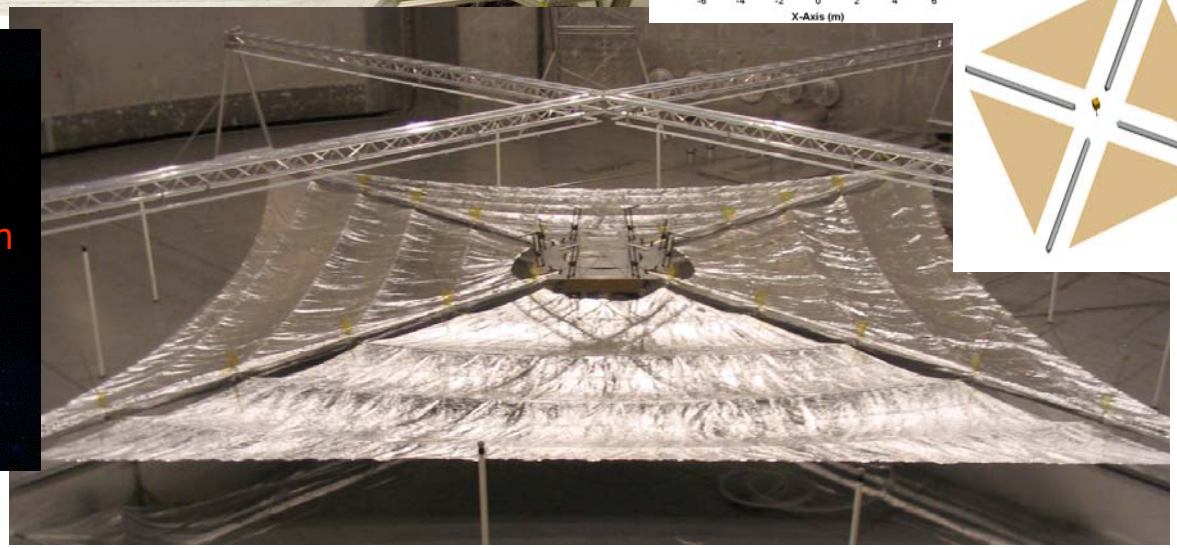


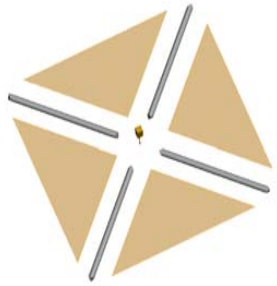




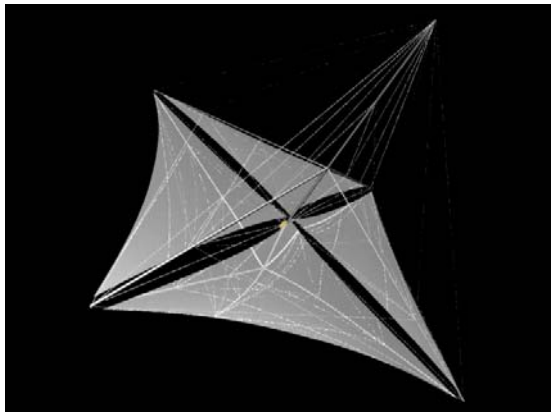


# Opportunities

- Cosmos I
  - Planetary Society
- Centennial Challenges
  - NASA, Exploration Systems Mission Directorate

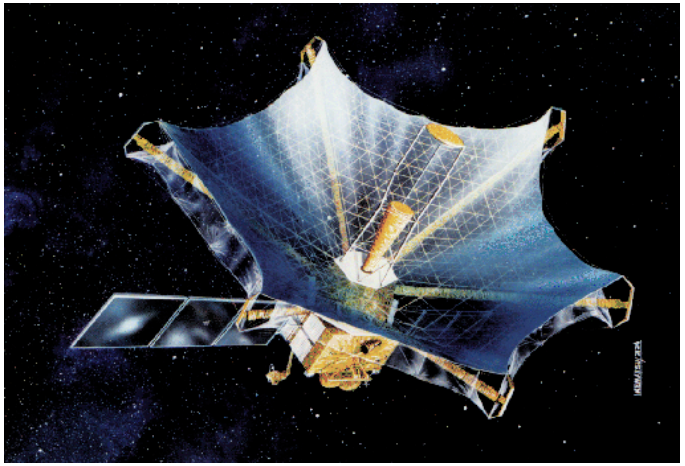
- Space Technology 9—solar sail flight validation
  - NASA, Science Mission Directorate
  - ST9 NRA released on 25 August 2004
  - Proposals due 24 November 2004
  - Phase A study of SSFV scheduled for March-September 2005

# ST9 Technology Capability Areas

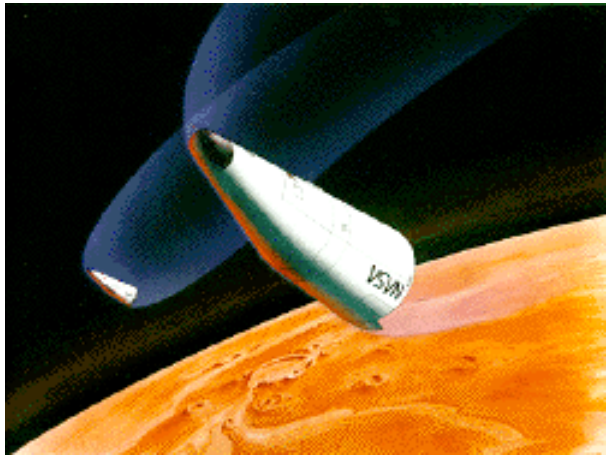


**Solar Sail Flight System Technology**

**System Technology for Large Space Telescopes**



**Precision Formation Flying System Technology**



**Aerocapture System Technology for Planetary Missions**

8/16/04

## Future Applications

**Solar Sail**

L1-Diamond

Solar Polar Imager

**Formation Flying**

TPF, MAXIM, Stellar Imager

**Large Space Telescopes**

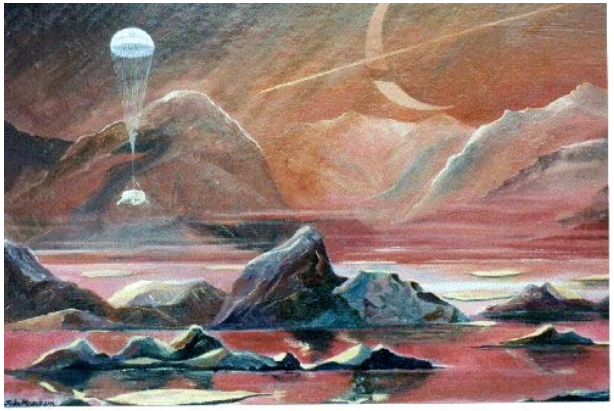
SAFIR, TPF, Life Finder

**Terrain-Guided Automatic Landing System (TGALS)**

MSL, Europa Lander, Mars Sample Return

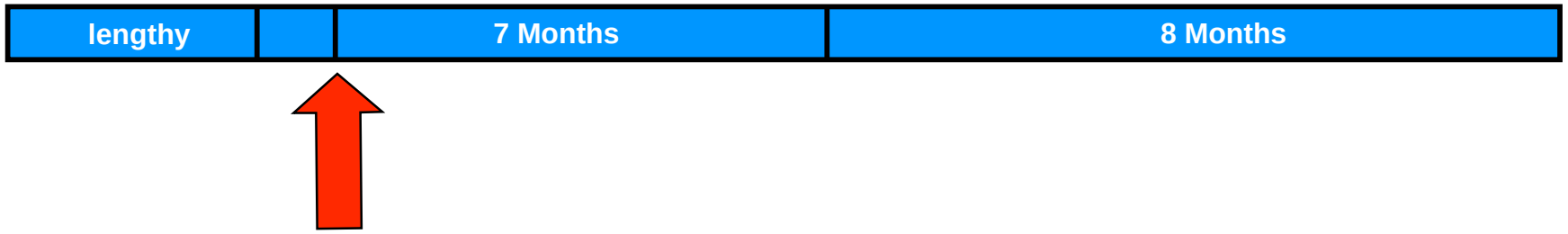
**Aerocapture**

Orbiter Missions at Bodies with Atmospheres, e.g. Titan, Venus, Mars, Neptune



**Descent and Terminal Guidance System Technology for Pinpoint Landing and Hazard Avoidance**

# System Validations (odd-numbered ST's)
# Pre-Formulation and Formulation Process




**NMP Leads**

Pre-Concept Definition Studies

NRA Solicitation/ Selection for Providers of Enabling Technologies

Results of Peer Review Presented To SSE AA

AA Selects Technology Providers

**Centers Lead**

Center-Led Concept Definition Studies

Independent Peer Review of Concept Definition Study Reports

SSE AA Selects Concept for Formulation Refinement

# Solar Sail Flight Validation Objectives

1. Validate solar sail design tools and fabrication methods
2. Validate controlled deployment
3. Validate in-space structural characteristics
4. Validate solar sail attitude control
5. Validate solar sail thrust performance
6. Characterize the sail's electromagnetic interaction with the space environment

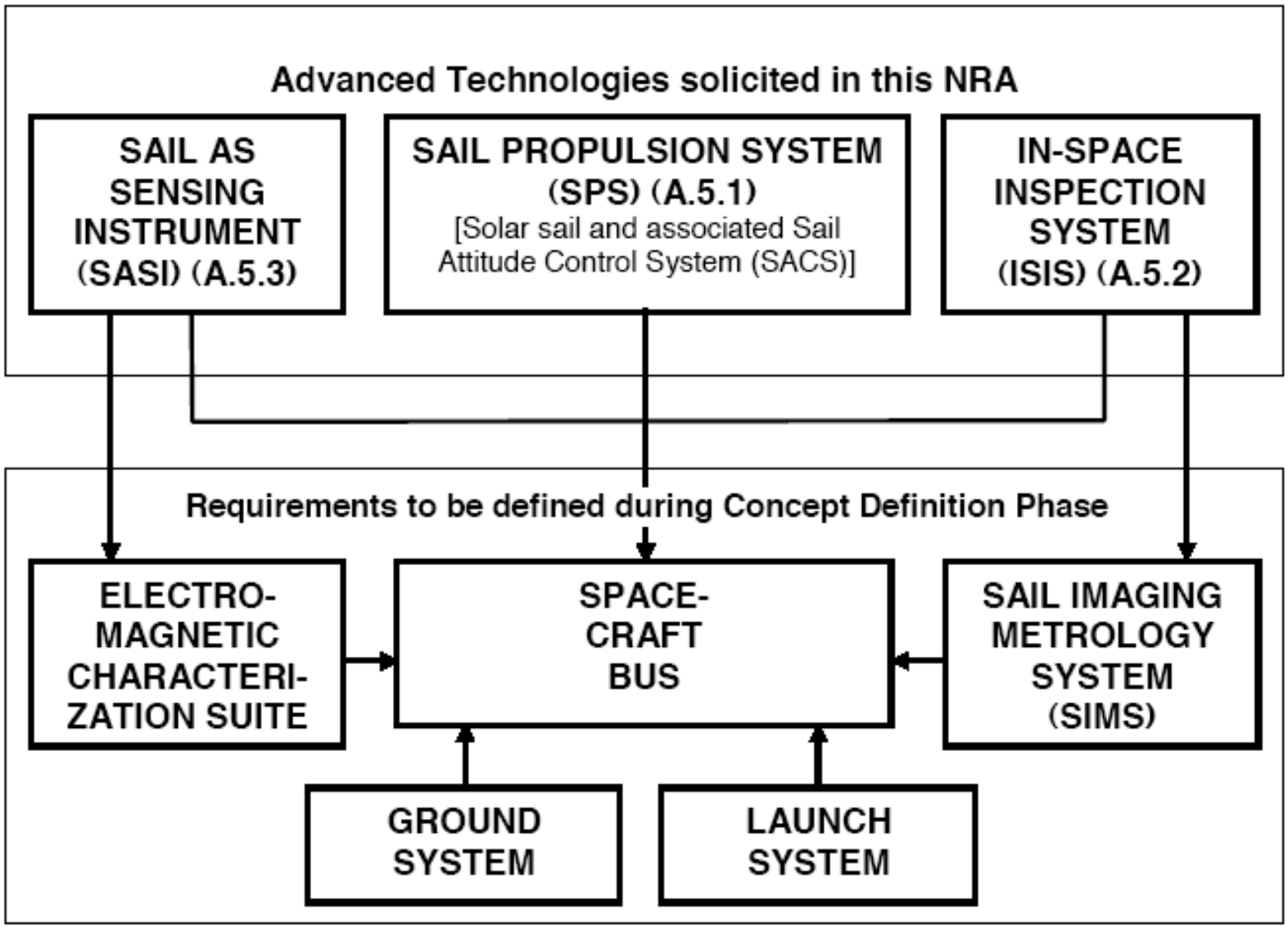



**Figure A-1. Major elements of the SSFV concept.**